R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Office of Research and Development

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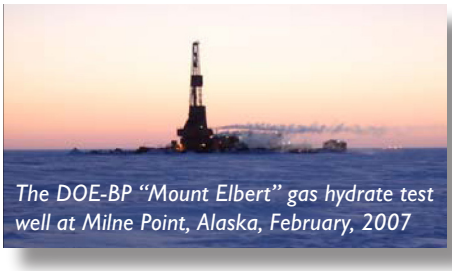
NETL-ORD's Methane Hydrates R&D Program

Background


The DOE-BP "Mount Elbert" gas hydrate test well at Milne Point, Alaska, February, 2007

Methane hydrates are naturally-occurring crystalline substances composed of water and gas, in which solid lattices of water molecules trap gas molecules in a cage-like structure. Once thought to exist only as a laboratory curiosity, gas hydrates are now known to be a widespread component of sediments in permafrost regions and on outer continental margins. The amount of methane sequestered in gas hydrates is probably enormous, but estimates of the amounts are highly speculative and vary significantly. It is generally accepted that the energy stored within the gas hydrate reservoirs of the worlds exceeds the volume housed in all the worlds known oil, gas, and coal deposits combined.

This recognition of the vast scale of gas hydrate occurrence leads to several critical public interest issues:

- *Resource potential:* Gas hydrates may be a key part of future energy portfolios, not only for the U.S., but for a number of rapidly-growing, but energy starved economies throughout the world.
- *Global Climate:* Gas hydrates are dynamic parts of the natural environment, and large-scale events of de-gassing in the geologic past have been linked to periods of rapid global climate change. Ongoing global warming has the potential to trigger additional methane releases from hydrates (particularly in the Arctic) which could further exacerbate warming trends.

- *Sea-floor Stability:* Gas hydrates may play a major role in strengthening deep marine sediments. Dissociation of hydrates, therefore, may lead to sediment instability and potential submarine landslides with the potential to trigger tsunami and other adverse impacts.

ORD's Program in Methane Hydrates

NETL ORD is supporting the DOE-led effort to fully understand the resource and environmental implications of methane hydrates in three critical areas:

- *Numerical Modeling:* NETL staff are directing the development of improved capabilities for modeling the behavior of gas hydrate-bearing sediments

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under changing environmental conditions. Central to this effort is an ongoing international comparison of existing computer codes. NETL also has made available to the public the only open source gas hydrate simulator, HydrateResSim. NETL is also the leader in molecular dynamics simulation of gas hydrate systems, and is conducting several critical fundamental studies with relevance to production and global climate issues.

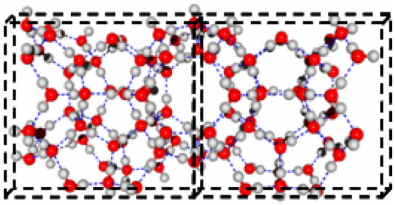
- *Development of Specialized Tools:* The nature of heat transfer through hydrate-bearing systems is one of the primary variables in assessing the potential for gas hydrate destabilization in nature. NETL has developed the most accurate, non-destructive, and efficient technology for the measurement of the thermal properties of hydrates and hydrate bearing sediments and is now augmenting this device for applications in the field.

- *Field Assessment of Gas Hydrate Geologic Systems:* NETL is leading the way in integrating geologic concepts into the traditional geochemical foundations of gas hydrates research. Through leadership positions in domestic and international expeditions, NETL is working to expand attention from traditional pressure-temperature considerations to include understanding of the sediment systems, gas and water sources and pathways, and reservoir traps and seals that are necessary to produce concentrated accumulations of gas hydrate.

NETL and USGS scientists collaborate as co-chiefs on India Gas hydrates expedition, Summer 2006

NETL-ORD Milestones – Next Five Years (2008-2012)

- Complete international comparison of gas hydrate reservoir simulators and publish inputs, outputs, and analyses on the world wide web.
- Complete seminal reports on the fundamental physical/chemical nature of gas hydrate systems through integrated molecular dynamic simulation, reservoir simulation, and experimental studies.



- Integrate NETLs thermal properties measurement technology into new tools for applications in the field, including pressure core analyses systems and new borehole applications.
- Lead DOE field efforts to conduct long-term production test in Alaska and a multi-well exploratory drilling expedition in the Gulf of Mexico.
- Continue to participate significantly in international gas hydrate programs, including those in India, China, Korea, Mexico, and Canada.

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